SECRET
(When Filled In)

AUTHORIZATION TO EXPEND FUNDS FROM OTHER COMPONENTS ALLOTMENTS

DATE: 20 May 1964

TO : Assistant Director, OSA-DD/S&T
THRU :
ATTN : (A) Chief, Budget & Finance Branch, OSA-DD/S&T
(B) Chief, Contracts Division, OSA-DD/S&T
SUBJECT : Request for Covert Contract

REFERENCE:

SUPPORT, OR SERVICES, TO BE PROVIDED

1. It is requested that the Contracting Officer, OSA-DD/S&T negotiate a contract with [redacted] on behalf of NPIC in an amount not to exceed [redacted] the details of which have been furnished separately regarding study on Photo Interpretation Performance.

25X1
25X1

2. Due to the covert nature of this activity the contractual and financial administration of these funds should follow presently established OSA procedures. A duly appointed OSA approving officer should approve each payment.

3. The amount stated above has been obligated and will be reported in the Summary Obligation Reports submitted by this office. The funds should be costed to the Allotment Number and Obligation Reference Number cited below.

4. If property is obtained from this contract, receiving reports will be obtained (and sterilized if necessary) and copies will be forwarded to the Office of Logistics and the Finance Division to insure recording in the Property Accounting System.

NGA review(s) completed.

CHARGEABLE TO

PROJECT

ALLOTMENT NO. 4155-1030-6000

OBLIGATION REFERENCE 2791-64

X A. EXPENSE B. 144.1 ACCOUNT

SIGNATURE OF ACCOUNTABLE OFFICER
25X1

IF CHARGEABLE TO ACCOUNT NO. 144.1

FORWARD RECEIPTS SUPPORTING EXPENSES TO

ROOM NO. | BUILDING N.A. | EXTENSION

DIVISION

FUNDS AVAILABLE

SIGNATURE

CONCURRENCE

SIGNATURE OF FINANCE DIVISION

FORM 1716 11-62 USE PREVIOUS EDITIONS.

SECRET

GROUP 1
Excluded from automatic downgrading and declassification

This was not taken before the TDC.

Research and Development
Project Approval Request

Memo sent to DDCI for approval of May 1964.

I. Identification

The proposed project, designated "Research on Photo Interpreter Performance," would follow up a pilot study on "Photographic Image Recognition as a Function of Ground Resolution" which was conducted by [redacted] and NPIC, to prove that information from this kind of experimental research is meaningful and useful to the photographic intelligence process. The proposed effort, endorsed by DD/S&T on merit of the successful pilot study, would be
25X1 funded by NPIC [redacted], would make use of NPIC facilities and experimental
25X1 subjects, and would be of joint interest to DD/S&T and NPIC.

This project is provided for in the NPIC's FY64 financial plan at the [redacted] level under two categories of Object Class 700: "Viewers and Other
25X1 Photo Interpretation Equipment" [redacted], and "Special Techniques and Develop-
25X1 ment Studies" [redacted] The remaining funds are available as a result of deferment of other projects for further investigation.

II. Objectives

In extending the findings of the pilot study, the proposed program would investigate three principal and basic areas of concern. Objectives would consequently be:

A. To determine the relation between P.I. performance and ground resolution of photography.
B. To assess the effects of stereo image viewing (as opposed to monocular viewing) as well as the effect of mixed-resolution stereo pairs on P.I. performance.
C. To investigate the effects of color photography on P.I. performance.

Findings will supply objective measurements which will serve to aid in the development and use of collection systems and exploitation equipment.

III. Background

In NPIC's particular intelligence effort, "man" -- the photo interpreter -- is the key element and yet he remains the most unknown factor in the total picture.

There are proven techniques for attaching numbers to systems capability (currently in terms of "modulation transfer function"); but there is no means, to date, of quantitatively accounting for or predicting or enhancing human performance as it relates to the quality and kinds of materials available in the interpretation task. This vagueness inhibits our development programs.

In general terms, we want first to ask ourselves what threshold of quality is incontravertibly set by accountable human factors? What degree of image quality is really needed for specific targets (for this will vary); and exactly what details do we want to be able to see in various targets? When do stereo and color, for instance, provide more information to the human visual system?

At long last, a value could be put on the direct benefits of resolution, stereo and color:

A. Results from the resolution study will aid in assessing the relative intelligence worth of various collection systems which yield different ground resolutions. This objective, in a skeletal version, formed the basis of the pilot study, but would now be specifically correlated with types and priorities of targets suggested by the operational components cooperating in the study. The resolution study will establish a benchmark from which effects of other physical factors can be measured.

B. From an investigation of stereo, NPIC would finally have in its hands some relative numbers for evaluating (or justifying) stereo as it directly contributes to identifying specific kinds of targets.

C. The study on color will include investigations of P.I. performance with monocular color images, of stereo images in which (1) both images are in color and (2) one image is in color and the other is in black & white. Variations in ground resolution will be introduced for both the monocular and stereo images. Results will be useful in deciding and detailing the roles that color might, with some degree of assurance, take in collection and exploitation.

In what is a relatively unexplored area, the first facts and findings will be necessarily basic and therefore important, with many side benefits.

Additional studies may be carried on simultaneously -- as they have an effect upon the overall investigation. For example: experiments at Harvard University's Center for Cognitive Studies suggest that image identification of degraded images can be strongly influenced by pre-conceptions, such as the sort of pre-conception a P.I. might unconsciously have gained in his own specialization (of target-type). Called "response perseveration," it can decidedly interfere with recognition. It also encourages a person's first notion about lower-grade information to stick in his mind, obstructing other alternatives. Findings from such research will be applied to the proposed

project and, in this case, might be incorporated as multiple-choice testing techniques. Further exploration and application might prescribe a scheme, for instance, of presenting collateral information to the P.I. and of assigning (or rotating) tasks for the most objective interpretation possible.

Another obvious offshoot is an investigation of basic aptitudes, background and personality traits which are essential to the successfully performing P.I.

Other factors of contiguous or future concern are:

1. contrast and brightness range
2. granularity
3. sun altitude and azimuth
4. obliquity

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7. scene change detection
8. season/terrain
9. searching and viewing time
10. viewing equipment/scale
11. collateral information
12. individual P.I. differences

IV. Technical Specifications

All findings and figures will be submitted in report form and will also be represented in graphs. Graphs, covering all important target-types, will plot ground resolution [redacted] against target identification. Curves for the same target-type will contrast stereo with monoscopic viewing and color with black & white.

25X1

With the help of operational components a survey of targets of interest (which are available within the U.S.) was designated. Photography should include:

1. Missiles (ICBM)
2. Electronics (antennae)
3. Military (air fields and submarine sites, with nuclear facilities)
4. Storage (military, ammo, BW/CW)
5. Industry
6. Transportation (land, sea, ports and harbors)
7. Power

For the following reasons, actual mission photography is unsuitable for the project and special flights must be flown: (1) techniques for simulating scale and resolution of photography require known and exact processing parameters so that accurate transfer function can be determined. (2) Images must be selected by specific recognition characteristics for purposes of testing. (3) For purposes of correlation, color photography must be identical to black & white photography and consequently must be shot at the exact same time.

However, as a doublecheck and also in the process of specifying sites to be photographed, the researchers will review Air Force reconnaissance (data) test flights. If material is suitable, it will be used. It is probably from this source that materials will be obtained for pretests, the purpose of which is to determine meaningful alternatives for mutiple-choice answers.

The OSA/Air Force will be responsible for providing the aircraft, cameras, and original film-processing necessary for collecting the photography. In the event that ground targets are required, the sponsor will make the necessary arrangements.

Since simulation techniques will be used for degrading resolution, the initial photography must be of high quality [redacted] Photography must also cover a long strip of terrain at least $\frac{1}{2}$ mile wide. It must provide at least 60% overlap between frames. Targets must be covered in both color and black & white. Further specifications have been discussed with the proposed contractors, and there is leeway for selecting the remaining parameters in terms of our logistical convenience.

25X1 V. Contractor and Financial Arrangements

Through joint agreement between DD/S&T and NPIC, [redacted] were asked to submit the only proposal as sole bidder and joint contractors. They are uniquely qualified in terms of professional competence, personnel thoroughly familiar with our operation, and investigative techniques specially adapted for our purposes. Moreover, the resolution simulation techniques were developed by [redacted] and are
25X1 proprietary in nature.

25X1 [redacted] will serve as principal investigator representing [redacted] will serve as principal investigator
25X1 representing [redacted] Ultimate responsibility for the research
25X1 will rest with [redacted]

[redacted]

VI. Coordination

From its inception the project has been coordinated with PID/NPIC and DD/S&T. The Office of Logistics has taken the preliminary steps necessary for contract negotiation.

A thorough survey of research and literature on the psycho-physiological aspects of the P.I. function was part of an earlier study performed for NPIC
25X1 by [redacted] in 1960. Recently, [redacted] has reviewed current research
25X1 in this field with NPIC technical personnel, and it was consequently concluded

that other efforts are not applicable to NPIC's standard of materials -- that is, based upon the quality of material now being acquired. It is also felt that (1). techniques used to date in service-sponsored studies of photo interpretation were inadequate in experimental design and did not yield objective criteria; and (2). that these and other studies did not ask questions analogous to NPIC interpretation tasks.

As a result, the contractors will from necessity collaborate closely with NPIC P.I.s and will correlate questions with the kinds of intelligence requirements presently levied on the Center. Looking to the future, projected requirements for image recognition will also be incorporated into the testing, since current intelligence requirements are most often defined to fit NPIC's present capability and not necessarily to exceed it.

As a general reference on the project, [redacted] will submit a short summary/evaluation of current and recent research which he judges partially relevant to this proposed undertaking -- either in terms of techniques or findings.

VII. Security

25X1

[redacted]

STATEMENT OF WORK

25X1

[redacted]

25X1

[redacted]

1 APR 64

STATEMENT OF WORK

At a meeting held during 30 March - 2 April, plans were formulated for the study of P.I. performance as a function of several physical image characteristics. 25X1

The meeting was attended by [redacted] 25X1

25X1 [redacted] representing N.P.I.C.; and [redacted] The proposed efforts described below are the results of this meeting.

Many physical and psychological factors affect the performance of photo-interpreters. Some of these factors are listed below, more or less, in order of decreasing anticipated magnitude of the effect on photointerpretation, and/or the order in which these factors must be better understood to more intelligently design camera equipment, photointerpretation equipment and procedures.

1. Ground Resolution
2. Stereo vs. Mono
3. Color vs. Black and White
4. Type of Stereo
   - --equal quality pairs
   - --mixed quality pairs
   - --black and white pairs
   - --color pairs
   - --color/black & white pairs
   - --angle of photography
5. Contrast Reduction due to Haze
6. Spread Function Shape
   - --symmetrical
   - --non-symmetrical
7. Granularity
8. Sun Altitude
9. Sun Azimuth
10. Obliquity

11. Response Perseveration

25X1

12. [redacted]

13.

14. Viewing Equipment/Scale

15. Viewing Time

16. Searching

17. Collateral Information

18. Scene Change Detection

19. Season/Terrain

20. Individual Differences

To thoroughly study all or a major portion of these effects at once will not only result in an experiment of tremendous magnitude but also seems unwise. Therefore, three alternative projects are proposed, each of which varies in scope in the number of variables or effects to be examined.

ALTERNATIVE PROPOSAL #1

The objective of the study will be to determine the relation between P. I. performance and the ground resolution of photography.

The results of the study will aid in assessing the relative worth of various collection systems yielding differential ground resolution. Furthermore, the data resulting from the first study will serve as a benchmark with which the effects of such factors as stereo, mixed stereo, color, atmospheric haze, spread function shape, and granularity may be measured in subsequent studies.

The acquisition of photographic material should be planned to achieve sufficient flexibility to investigate all the aforementioned factors. To limit the photography to that required for Proposal #1 only would be a mistake.

ALTERNATIVE PROPOSAL #2

The objectives of this work are as follows:

1. To determine the relation between P.I. performance and ground resolution (the aforementioned benchmark).
2. To assess the effects on P. I. performance of stereo image viewing as opposed to monocular viewing.
3. To assess the effects on P.I. performance of viewing mixed-resolution stereo pairs.

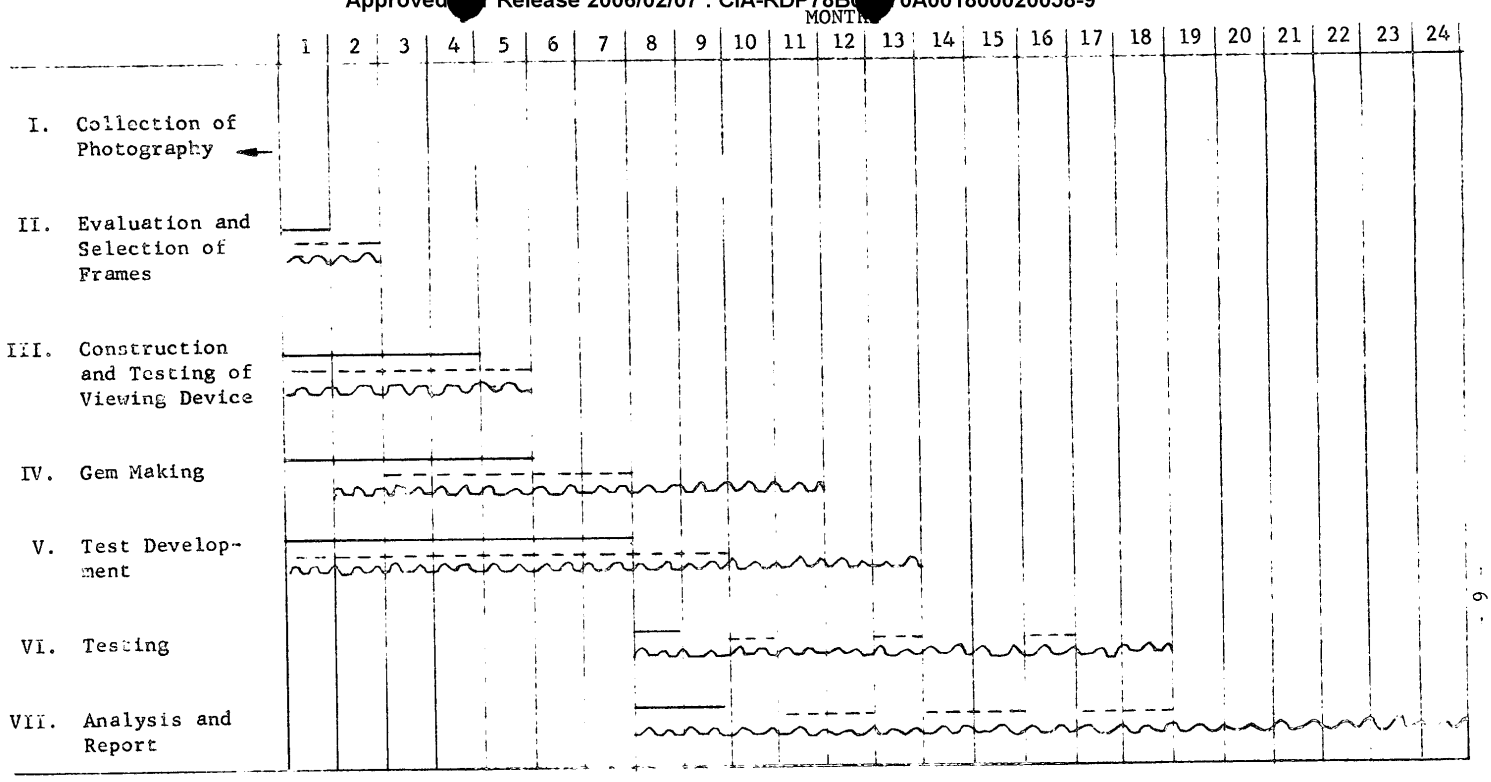
The results of this study will permit a quantitative assessment of mono versus stereo systems, as well as a comparison of two types of stereo. Likewise, the results will indicate which type of photography is best for any of the specific target-types studied.

ALTERNATIVE PROPOSAL #3

This alternative is the same as #2 with the exception that the effects of color photography on P.I. performance will be investigated. It would include investigations of P.I. performance with monocular color images, of stereo images in which both images are in color and in which one image is in color and the other is in black and white. Variations in ground resolution will be introduced for both the monocular and stereo images.

The results of the work proposed in this alternative would be useful in the ways described in Alternatives #1 and #2. In addition, they would permit the user to make decisions regarding the utility of obtaining color photography at specified resolutions.

It is felt that the sponsor should anticipate the necessity for conducting all of the studies described even though the sponsor may initially wish to conduct only a portion of them.



LEGEND

——— Alternative Proposal No. 1: Ground Resolution

– – – – Alternative Proposal No. 2: - Ground Resolution
- Stereo vs. Mono
- Mixed Quality Stereo

~~~ Alternative Proposal No. 3: - Ground Resolution
- Stereo vs. Mono
- Mixed Quality Stereo
- Color Mono
- Color Stereo
~~~

It is anticipated that the sponsor will be responsible for providing the aircraft, cameras, and original film-processing necessary for collecting the photography. In the event ground targets are required the sponsor will make the necessary arrangements. At the same time, the contractors will be responsible for the manner in which the photography is performed; the contractors will, in other words, prepare the flight plan and accompany the air crew during all of the photographic missions.

From a brief survey of targets of typical interest and of those available for photography within the U.S., it was concluded that the photography should include:

1. Missiles, I.C.B.M.
   5 Minutemen Sites
   5 Titan Sites
   5 Atlas Sites

2. Electronics
   20 Radar Dish Antennas
   20 Stick Mast Antennas

3. Military
   20 Air Fields
   5 Air Fields with Nuclear Facilities
   5 Submarine Sites

4. Storage
   20 Sites: Military, Ammo, BW/CW

5. Industry
   20 Sites

6. Transporation
   20 Sites: Land, Air-A/F & A/C, Sea, Ports and Harbors, Ships at Sea

7. Power
   15 Sites

With proper flight path planning, it is anticipated that from a large number of film frames, 75 can be selected which contain all of the targets listed above. Likewise, GEMS with a ground resolution range of [redacted] 25X1

25X1 [redacted] in 5 increments are planned for use in the study. The range of ground resolution will depend on the scale of photography which is to be simulated. In each of the proposals described above, the following image characteristics will be held constant:

1. Scale
2. Granularity
3. Spread Function Shape
4. Sun Altitude
5. Haze
6. Verticality of Photography.

Prior to proceeding with the viewing of CEMS by photointerpreters, sufficient pretesting will be conducted to establish sound P.I. performance measures and the validity of testing procedures.

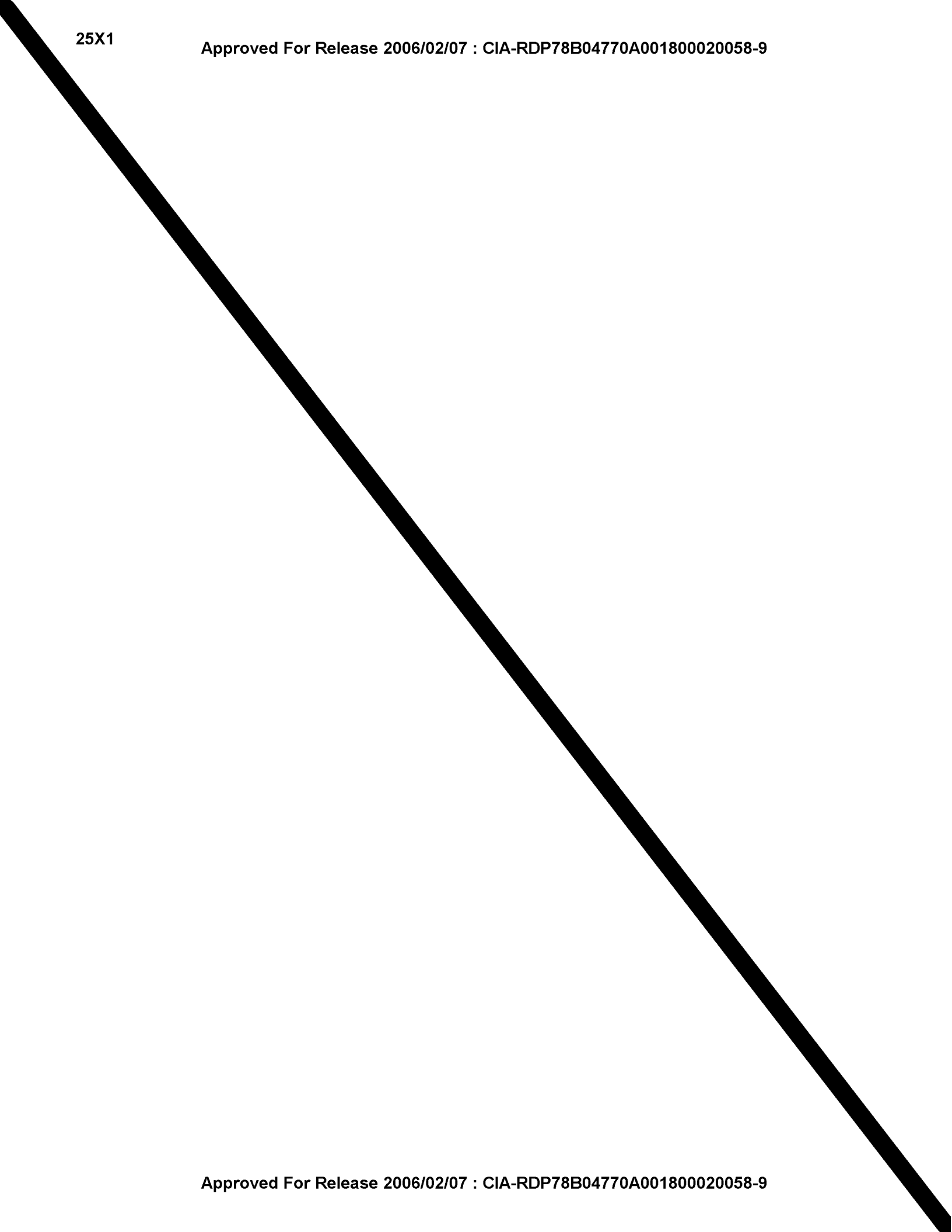
Plans include the construction and use of a microscope stage which will readily locate the specific target areas on the CEMS to be examined by the photo-interpreters. This will eliminate excessive time consumption of searching and will improve the accuracy of results, reducing errors due to mislocating.

The work will be conducted jointly by [redacted] 25X1

25X1 [redacted] will serve as principal investigator representing [redacted] will serve as 25X1

principal investigator representing [redacted] It is assumed that 25X1

25X1 [redacted] will serve on the project as a research associate. Ultimate responsibility for the research will rest with [redacted] 25X1



Approved For Release 2006/02/07 : CIA-RDP78B04770A001800020058-9

MEMORANDUM FOR:

[redacted] PRELIMINARY STUDY EFFECTIVE 13 APRIL 64 ON OPEN-END CONTRACT. NOTIFIED. PER [redacted] #6855

[redacted] PILOT STUDY CONTRACT EXTENDED — NOTIFIED, PER [redacted] (DATE)

FORM [redacted] 101 REPLACES FORM 10-101
1 AUG 54 WHICH MAY BE USED.

Robin
is this awaiting
some action?

April 7, 1964
MW-N-9

Dear John: JWC

We are pleased to submit our proposal for the continuation of the work described in my March 17, letter (MW-N-8). The proposal covers three alternative magnitudes of effort as described in the attached Statement of Work and Cost Breakdown. We suggest a continuation of the contractual arrangement currently contemplated. Our proposal covers only in-house work and does not include any monetary coverage for [redacted] 25X1

Regards,

Charlie

Charlie

mw
Attachment

25

CONTRACT INSPECTION REPORT

CONTRACT N

25

TO:

ENGINEERING SECTION/CB/PD/OL

DATE
5 August 1964

INSPECTION REPORT NO. *(If final, so state)*
1st and final

ESTIMATED COMPLETION DATE
30 June 1964

NAME OF CONTRACTOR

25X1

TYPE OF COMMODITY OR SERVICE

THE CONTRACTOR IS ON SCHEDULE ☐ YES ☐ NO NA

PER CENT OF WORK COMPLETED _____ NA

THE CONTRACTOR WILL PROBABLY REMAIN WITHIN ALLOCATED FUNDS ☒ YES ☐ NO IF ANSWER IS "NO" ADVISE RECOMMENDATION AND/OR ACTION OF SPONSORING OFFICE, ON REVERSE HEREOF. IF KNOWN, INDICATE MAGNITUDE OF ADDITIONAL FUNDS INVOLVED.

HAS AN INTERIM REPORT, FINAL REPORT, PROTOTYPE, OR OTHER END ITEM BEEN RECEIVED FROM THE CONTRACTOR DURING THE PERIOD? ☐ YES ☒ NO *(If yes, give details on reverse side.)*

HAS GOVERNMENT-OWNED PROPERTY BEEN DELIVERED TO CONTRACTOR DURING THIS PERIOD? ☐ YES ☒ NO *(If yes, indicate items, quantity, and cost on reverse side.)*

OVERALL PERFORMANCE OF CONTRACTOR

1. ☐ OUTSTANDING
2. ☒ SUPERIOR
3. ☐ EXCELLENT
4. ☐ HIGHLY SATISFACTORY
5. ☐ ACCEPTABLE
6. ☐ BARELY ADEQUATE
7. ☐ UNSATISFACTORY

IF OVERALL PERFORMANCE OF CONTRACTOR IS UNSATISFACTORY OR BARELY ADEQUATE, INDICATE REASONS ON REVERSE SIDE.

RECOMMENDED ACTION

☐ CONTINUE AS PROGRAMMED

☐ WITHHOLD PAYMENT PENDING SATISFACTORY PERFORMANCE

☐ TERMINATE NA - interim contract terminated 30 June 1964

☐ OTHER *(Specify)*

IF TERMINATION IS RECOMMENDED OR IF THIS IS A FINAL REPORT ATTACH COMMENTS IN NARRATIVE FORM ON CONTRACTOR'S PERFORMANCE AND CERTIFY THAT ALL DELIVERABLE ITEMS UNDER THE CONTRACT HAVE BEEN RECEIVED. THESE INCLUDE, WHERE APPLICABLE, THE FOLLOWING:

ITEM	REC'D	DOES NOT APPLY	ITEM	REC'D	DOES NOT APPLY
PROTOTYPES			MANUALS		
DRAWINGS AND SPECIFICATIONS			FINAL REPORT		
PRODUCTION AND/OR OTHER END ITEMS			SPECIAL TOOLING		
			OTHER GOVERNMENT PROPERTY		

DATE OF LAST CONTACT WITH CONTRACTOR
NA

SIGNATURE OF INSPECTOR

25X1

INSPECTOR'

DIVISION
P&DS

SIGNATURE OF APPROVER

25X1 [redacted] primary offering during this interim contract was four-day seminar held at their facility for representatives from [redacted] 25
25X1 NPIC, and [redacted] involved in the study on PI performance. The outstanding program of lectures and discussions, to which two other member's of [redacted] 25 research staff also contributed, was extremely thorough and pertinent to the project.

25X1 [redacted] kept in exceptionally close touch with our in-house progress in gathering domestic photography, and we had frequent phone conversations 25X1 with him on [redacted] aspects of the project.

In relation to their statement of work (for March 16 through June 30, 1964) 25X1 the tasks outlined by [redacted] "to be actively pursued" in that period can be evaluated as follows:

1. "Obtain ordered lists of targets (scene objects)."
25X1 This was supplied by [redacted] and involved no work on
25X1 [redacted] part.

2. "Obtain listing of availability of desired targets in the U.S."
The listing was drawn up and the photographs collected by P&DS:
25X1 no [redacted] effort was required.

3. "Formulate in detail the experimental design required to achieve the project objectives."
The experimental design was [redacted] primary concern and, 25
in this period, involved minor (if any) work on [redacted] part. 25

4. "Request photography of certain targets under specified conditions, and monitor this effort."

25X1 [redacted] spent two different sessions here specifying parameters for the overflights to the appropriate people. The flights are planned for August and will be monitored by [redacted] since 25
the area selected is (nearby) on the West Coast. [redacted] will 25
plan to receive the film at [redacted] and will advise on the processing 25
there.

5. "Begin preparation of GEMS." This is scheduled for September.

Please Forward to [redacted] 25X1

P. I. Performance eval.

25X1 [redacted]

8 April 1964

Dear L[redacted]

Our photography requirements can be generally summarized by:

1. Must have ground resolution [redacted] 25X1
2. Must cover a long strip of terrain at least 1/2 mile wide
3. Must provide at least 60% overlap of terrain between frames
4. Must be able to photograph in both color and black and white.

And a specific example stated as follows: (using round figures)

1. Ground resolution [redacted] 25X1
2. Assume use of camera with 9"x9" frame format resolving 33 l/mm
3. One camera-image line-space pair at 33 l/mm = 30µ
4. Since we must resolve 150,000µ on ground, and can resolve 30µ in camera, the scale

   $$\frac{150,000}{30} = 5,000$$

   of 1:5000 is established
5. If the camera has a 2-feet focal length lens, it must be operated at 10,000 ft. altitude
6. Assuming that the imagery in the center 7-inch square area within the 9-inch square format is of sufficient and sufficiently uniform quality, a strip of terrain 0.6 miles wide can be used.

Since there are a large number of combinations of format size, altitude, lens focal length, resolving power, etc., which would satisfy our needs, a most logical choice of combinations would seem to be one which is logistically most convenient to all concerned. For example, a [redacted] HR-320 camera flown at 16,600 feet is suitable, but possibly another camera is more readily available. Therefore, I hope you can arrange for me to meet with someone who is familiar with the availability of, and problems associated with, particular camera/aircraft combinations. Such a meeting would be very convenient for me on 15 April, the day following your meeting. 25X1

Best regards, 25X1

[redacted]

CC: J.W.C.
D.N.B.
F.F.

6. "Begin preparation of performance measures."

25X1 This is [redacted] task and yet to be done, but not because either contractor is behind schedule. Progress of the study was dependent upon the initial collection of available photography and the scheduling of overflights. (This was accounted for in their confined work schedule which accompanied 25X1 [redacted] proposal for "Extension of Research on PI Performance" received in April 1964)

7. "Submit a detailed statement of work, cost estimate and schedule for work to be performed during 1 July 1964 to 30 June 1965."

8. "Data from the study recently concluded by NPIC, [redacted] and 25
25X1 [redacted] will be subjected to an error analysis. A report will be prepared describing the results."

The report was prepared and submitted by [redacted] 25
and did not, require participation by [redacted] 25

As these specific evaluations indicate, there were tasks spelled out for the interim contract period which will actually be performed 25X1 during the contract [redacted] which followed and was negotiated 19 June 1964.

SIGNED

25X1 [redacted]

Development Branch, P&DS